THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

155/2 **FOOD AND HUMAN NUTRITION 2**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2015**

Instructions

1. This paper consists of sections **A** and **B**.
2. Answer all questions in section **A** and only **two (2)** question from section **B**.
3. Non-programmable calculators may be used.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. You are provided with sample P and solutions Q, R and S. Carry out the following procedures: (i) Place 10 ml of sample P in a test tube and add 3 drops of solution Q. Warm gently in a water bath. Record your observations. (ii) In another test tube, add 5 ml of sample P and introduce 3 drops of solution R. Heat to boiling. Record your observations. (iii) To a fresh 5 ml portion of sample P, add 1 ml of solution S. Stir and observe the changes.

Questions

(a) Identify sample P.

(b) What property of the main nutrient is demonstrated in procedure (i)?

(c) Name the nutrient demonstrated in procedure (ii).

(d) What chemical reaction is shown in procedure (iii)?

(e) Give two functions of the nutrient in human nutrition.

Answer

(a) Sample P is milk, which contains proteins, fats, and lactose sugar.

(b) In procedure (i), the property demonstrated is the reducing nature of lactose, which reduces copper (II) ions in Benedict's reagent to copper (I) oxide, forming a red precipitate.

(c) In procedure (ii), the nutrient demonstrated is protein (casein), which coagulates when milk is boiled with acid.

(d) In procedure (iii), the chemical reaction shown is enzymatic coagulation by rennin or similar enzymes, which convert caseinogen into insoluble casein.

(e) Nutritional functions of milk protein include growth and repair of body tissues, and supplying essential amino acids for enzyme and hormone synthesis.

2. You are provided with fruit sample T. Slice it into four equal portions and immediately perform the following treatments: (i) Leave the first portion on a clean plate. (ii) Dip the second portion into cold distilled water. (iii) Rub the third portion with common salt. (iv) Place the fourth portion in boiling water for 2 minutes. Leave all the portions exposed for 15 minutes and record your observations.

Questions

(a) What reaction occurred in the untreated slice?

(b) How did treatments (ii), (iii), and (iv) influence the reaction? Explain.

(c) Explain two ways this reaction can be prevented in food industries.

Answer

(a) The untreated slice underwent enzymatic browning caused by oxidation of phenolic compounds by

the enzyme polyphenol oxidase in the presence of oxygen.

(b) Treatment (ii) with cold water reduced browning by limiting oxygen contact. Treatment (iii) with salt slowed browning by altering pH and inhibiting the enzyme. Treatment (iv) with boiling water prevented browning by denaturing polyphenol oxidase.

(c) In food industries, enzymatic browning can be prevented by blanching fruits to denature enzymes, or by using chemical preservatives like ascorbic acid, sulphites, or citric acid to inhibit oxidation.

3. You are provided with samples U, V, W, X and Y. Perform the following procedures: (i) Accurately weigh 5 g of sample U into a conical flask. (ii) Add 50 ml of solution V into the flask. (iii) Introduce 1 ml of solution W and swirl thoroughly. (iv) Heat the mixture in a water bath at 70–75 °C for 10 minutes. (v) Titrate the hot mixture against solution X until the colour changes permanently. (vi) Repeat step (v) to obtain concordant titres.

Questions

(a) Identify solution V and its role in this experiment.

(b) What was the purpose of adding solution W?

(c) Calculate the saponification value of sample U.

(d) From literature, normal cooking oils have saponification values between 190–200. Compare your result with the literature value and state its significance.

(e) Suggest two reasons why the heating in step (iv) is necessary.

Answer

(a) Solution V is alcoholic potassium hydroxide (KOH). Its role is to hydrolyse the triglycerides in the oil or fat (sample U) into glycerol and potassium salts of fatty acids.

(b) Solution W acts as an indicator, commonly phenolphthalein, which helps detect the endpoint during titration by showing a colour change.

(c) The saponification value is calculated using the formula:

Saponification value = (56.1 × N × V) / weight of oil

Where N = normality of HCl used to neutralise excess KOH, V = volume (ml) used, and weight of oil = 5 g. Since actual titre values are not given in the question, students are expected to substitute their experimental results to get the saponification value.

(d) If the calculated value is within 190–200, the oil is normal and suitable for cooking. A lower value indicates long-chain fatty acids or adulteration, while a higher value suggests short-chain fatty acids or rancidity.

(e) Heating in step (iv) is necessary to accelerate hydrolysis of triglycerides and to ensure complete saponification of the fat sample for accurate titration results.